

THE SIZE, COMPOSITION AND FISSIONING IN BABOON TROOPS  
(*PAPIO URSINUS* KERR, 1792)

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ABSTRACT

Several baboon troops were studied during a two year study period. Sub-troop formation in troops was regularly observed and such sub-troops are defined as temporary or semi-permanent. Sub-troops are either normally or abnormally composed as far as age and sex classes are concerned. A temporary sub-troop sleeps apart from the main sub-troop, and these sub-troops reunite the following morning. A semi-permanent sub-troop separates from the main sub-troop for several days. During this period the semi-permanent sub-troop only joins the main sub-troop at sleeping places. The behaviour of certain males is prominent when sub-troops are formed. This study revealed that the baboon troop is wrongly referred to as a stable unit.

Very few field studies on the ontogeny and permeability of baboon troops have been conducted. As these subjects need prolonged investigation, one year's field-work can only indicate some of the factors which are involved in the process of new troop formation. However, sub-troop formation in natural troops is the most important phenomenon to consider when studying the formation of new troops.

The distances between members of non-human primate troops or groups depend on the relative position of individuals in the social hierarchy (Carpenter 1942; Hediger 1961; Calhoun 1963) as well as on environmental factors and time of day or night. Although baboons live in socially well-organized troops which possess relatively stable intra-troop relationships, members of troops split from the main body to form sub-troops (Zuckerman 1932; DeVore and Washburn 1963; Stoltz and Saayman 1970). Therefore, only consecutive countings on different days could determine whether a group of baboons found at their sleeping, drinking or feeding place, is part of a bigger troop or whether they represent a stable troop.

Large troops in the Nairobi and Amboseli Parks of 77; 88 and 94 baboons respectively, frequently split into smaller sub-troops (DeVore *et al.* 1963). Mothers with infants joined the section of the large adult males. However the sub-troops always re-united before nightfall. In contrast Zuckerman (1932) and Stoltz *et al.* (1970) found that sub-troop formation was often displayed in the evening which resulted in the sleeping apart of the two sub-troops. Kummer (1968) observed congregation or separation amongst hamadryas baboons in the evening.

DeVore *et al.* (1963) found that troops exceeding 70 animals became unstable. Then sub-troops, each with a centre, (females, young and dominant males), a periphery and the characteristics of a normal independent troop, were formed. They therefore suggested that subdividing or fissioning might have been the first stage in the formation of new troops.

Until recently, baboon troops were wrongly referred to as socially stable units. Also they are not "closed societies" which do not permit strangers into the troop (DeVore 1963), since Rowell

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(1966) and Altmann and Altmann (1970) observed adult male baboons moving from one troop to another. Experimentally introduced adult female baboons were accepted by a troop (Saayman 1968) while the same troop did not tolerate a strange adult male (Stoltz *et al.* 1970). Troops reacted differently to the introduction of adult males, adult females and migrating adult males.

The object of this study was mainly to obtain data on the division and congregation of troops with minimum interference with their normal pattern of activity, and secondly to determine experimentally the size of the smallest stable troop.

#### PROCEDURE

The division of troops and the congregation of sub-troops were studied on consecutive days for periods varying between two and twelve days. Two troops, RB and W, of the nine baboon troops inhabiting a 500 km<sup>2</sup> study area at Tshipise in the northern Transvaal, were studied (Stoltz *et al.* 1970). The troops were followed on foot throughout the day for a total of 75 days which were divided into six observation periods during an 18 month period (July, 1967–December, 1968). Troops and sub-troops were counted with the aid of 7 x 35 binoculars or a 40 x 60 telescope. Baboons were counted as they passed through an open area in the dense vegetation, or while ascending or descending a sleeping ridge. A tape recorder was used to record sexes and ages.

Experiments were conducted to determine the size of the smallest stable troop. During experimental control methods in the Messina district in the northern Transvaal, troops were reduced to 5% of the original number and the effects on the remainder of the troop were studied. In addition experiments, during which troop members were captured or individuals were introduced into another troop, were carried out on W troop and troops adjacent to the study area (Stoltz *et al.* 1970). Capture cages were used to catch and transport troop members (Keith and Stoltz 1971). The aim of this part of the study was to measure troop permeability and to obtain data on the smallest troop that could exist independently.

#### RESULTS

Altogether 51 instances of sub-division by troops RB and W were recorded during the study. The number of animals in a sub-troop varied from one to half the number of the original troop.

##### 1. *The size, composition and organization of original troops*

Troop size was said to be normal when routine counts during the study period failed to show any marked changes in the number of baboons per troop. Although the numbers of W and RB did not remain constant, the total number of baboons in these troops was at its maximum during most of the observation days. The average composition and size of RB and W during the period 7/67 to 11/68 is shown in Table 1. The average adult male to adult female ratio was 1:1,6 for both troops. The relationship between sub-division and social organisation in a troop is interesting. No evidence for the existence of one leader male was found in W troop in the study area at Tshipise. Three large males, Y, B and ST, each with his specific functions, co-

TABLE I  
THE AVERAGE TROOP COMPOSITION OF W AND RB TROOPS. CENSUS FIGURES  
FOR THE PERIOD 7/67 TO 11/68

| Name of troop | Adults |        | Total adults | Immature male and female | Troop total | Adult Male/female |         |
|---------------|--------|--------|--------------|--------------------------|-------------|-------------------|---------|
|               | Male   | Female |              |                          |             | Female/immature   |         |
| W             | 18     | 30     | 48           | 24                       | 72          | 1 : 1,7           | 1 : 0,8 |
| RB            | 18     | 24     | 42           | 16                       | 58          | 1 : 1,5           | 1 : 0,7 |

operated in maintaining leadership, directing troop movements and displaying vigilance (Stoltz *et al.* 1970). Male Y weighed about 30 kg and was in excellent condition. He was of a more robust physical stature and was thought to be older than the other two dominant males. Y was always accompanied by mothers and their offspring. Mothers groomed this baboon more often and preferred his company to that of the other two dominant males (Saayman, *personal communication*). The following field observation demonstrates this male's affection for infants.

Field Observation: 15.1.68 – 1600 h:

Y rested close to a mother cuddling her infant. Three one-year-old infants and one eighteen-month-old yellow infant played near Y. An oestrous female joined the party and settled down to groom Y. The yellow infant walked past the oestrous female and climbed onto Y. The oestrous female made several attempts to intrude upon Y and the infant's game by pulling the infant from Y. She lifted the infant by his ear and dropped him onto the rocks below. The infant screamed. Y became agitated and snatched at the female nearest him. Meanwhile the oestrous female had chased the yellow infant into a tree from where he continued to scream. Y ran to the tree where the oestrous female threatened the infant and chased another juvenile into an adjacent tree. Y furiously broke off branches in an attempt to reach this juvenile. Eventually the juvenile fell from the tree whereupon Y ceased his aggressive behaviour and returned to his resting place. The four infants, including the yellow one, followed by two mothers, returned to Y and the infants resumed their play.

#### Comment

Y was obviously antagonised by the screams of the infant. Instead of biting his consort oestrous female that had threatened the infant, he snatched at another female and chased a juvenile into a tree. This displaced aggressive behaviour demonstrated the concern of the old male for the screaming infant, but in the prevailing circumstances he did not support the female in catching the infant neither did he protect the infant.

Another function of Y was to direct troop movements. The family group with Y might lead the troop and occupy this leading position for several hours.

Field example: 25.7.67 (T=30°C) 1300 h:

1300. W troop sat under trees close to the canal. Y was asleep.

1320. Y was still asleep. Two pairs of females groomed one another. Three infants were asleep, one on his side, the other two on their tucked in legs. Six other animals were sleeping on their sides.

1400. Y awoke, got up and slowly ascended the kopje. General movement among troop members was noticeable.

1530. The two dominant males, Y and ST were accompanied by five mothers with their infants. Three mothers were carrying their infants. They moved slowly to the south while foraging.

1545. The rest of the troop followed the family unit at a distance.

1635. Y still occupied the leading position of the troop. He was accompanied by four mothers, six infants and two small juveniles.

1700. Y returned to the alternative sleeping place along the same route that he had followed from 15.30 h. He was still accompanied by four mothers (two carrying infants), six infants and two small juveniles. The rest of the troop followed in a widely scattered formation.

#### *Comment*

Y usually took the lead when his troop was under conditions of stress e.g. when the troop entered the core area of another troop. Under these circumstances B and ST tended to occupy positions at the rear of the troop. When troop W left such a dangerous area, B usually occupied a leading position.

During aggressive conflicts between the dominant males, Y and ST often picked up an infant when directly approached by B. With the infant in his arms the male would then run off a few yards, sit down and groom the infant. B would then immediately stop his aggressive actions. Unlike the other dominant males, B never handled an infant. On several occasions infants tried to attract B's attention but he always ignored them. The social relations between Y and mothers and infants are interesting, and will be discussed later.

#### *2. The occurrence and behaviour of solitary animals*

No solitary males were observed in the actual home ranges of these two troops, but five single adult males were often noticed in the area adjacent to the study area. They were often seen in one particular locality but it cannot be claimed with certainty that they were the same five baboons since they were not marked. These males presumably returned to their troops as Altmann *et al.* (1970) and Rowell (1966) found amongst other baboon subspecies.

It was noted by Stoltz and Keith (1972) that lone marauding males were in many instances responsible for the destruction of small livestock and agricultural products. Whereas males can

be temporarily or permanently separated from their troops, females which had lost contact with their troops, actively tried to regain contact by continual communication calls. These calls were typical and differed from the alert warning call.

Field example: 16.1.68 – 0500 h:

0500. A female of W troop sat alone with her dead infant at the main sleeping place. She groomed the baby intensively.

0516. The female looked around continually uttering communication calls.

0518. Carrying the dead infant, the female moved in the direction where the troop had disappeared but did not succeed in regaining contact. She moved along from one high peak to another.

0532. The female continued calling although she got no response from other troop members. She sat down at intervals to groom her dead infant.

0535. The female finally reached the troop.

#### *Comment*

At no time were females observed to be on their own for periods exceeding 35 minutes. Juveniles were usually separated from the rest of the troop by accident. As soon as they realized that they were on their own, they stopped all activities to bark.

### 3. *Sub-troops*

Sub-troops occurred when groups of animals became temporarily separated from the main body of the troop. The authenticity of sub-troop formation depended on whether the sub-troop maintained visual or auditory contact with the main body. Genuine sub-troops completely lost contact with the main body and stayed isolated for at least one night.

#### *(a) The time of division*

Troop division in W had two peak periods i.e. between 0500 and 0700 h and again between 1100 and 1400 h (Fig. 1). These were the times at which the left-overs from the hotel kitchen became available. Troop division in RB occurred mostly between 1100 h and 1300 h when members of the troop were at rest during the midday "siesta". Both RB and W troops sometimes divided at dusk when the troop arrived at the sleeping place. W troop usually slept in one sleeping place but formation of sub-troops took place on some nights when either the main and alternative, or else the main and additional sleeping places were used. Troops seldom divided when out of their core area. Core areas were those which included a drinking place and a preferred feeding or sleeping place. Baboon troops spent about 80% of their time in these areas (Fig. 9 in Stoltz *et al.* 1970).

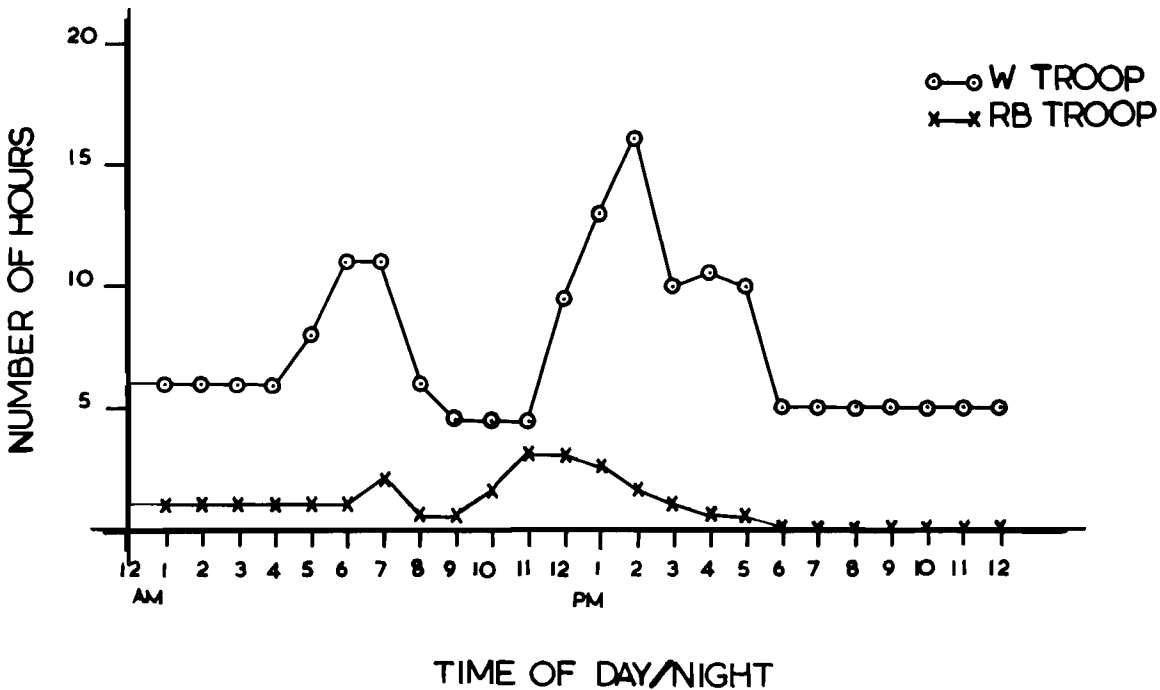


FIGURE 1

Number of hours when W troop and RB troop were divided during 1 320 hours of observation.

(b) *The frequency of division*

When comparing the frequency of division in W troop with that of RB troop, W troop divided on 42 occasions whereas RB troop divided on nine occasions only. Visits to the excess food at the hotel and garbage dump by members of W troop increased the frequency of division. Troop W was under observation for 768 hours and troop RB for 552 hours.

During three 10 day study periods (July, 1967 and July, 1968 for W troop, and October, 1967 for RB troop) sub-troop formation occurred more frequently in W than in RB troop.

(c) *Total hours of separation*

W troop was divided for 173 hours while RB troop was divided for 23 hours only. During July, 1968 troop W was divided for many hours since male Y and accompanying mothers with infants slept apart from the main troop for five of the ten observation days. When comparing the October, 1967 observation period on RB with the July, 1968 observation

TABLE 2  
THE FREQUENCY OF DIVISION IN W TROOP AND THE NUMBER OF HOURS DIVIDED

| Period                 | Frequency<br>of<br>division | Hours divided    |             |                    | Hours<br>together<br>day and night | Total<br>hours |
|------------------------|-----------------------------|------------------|-------------|--------------------|------------------------------------|----------------|
|                        |                             | Day<br>Core area | Day<br>Veld | Night<br>Core area |                                    |                |
| 10 days<br>July '67 .. | 15                          | 32               | 1           | 12                 | 195                                | 240            |
| 12 days<br>Jan. '67 .. | 18                          | 67               | 0,5         | 12                 | 208,5                              | 288            |
| 10 days<br>July '68 .. | 9                           | 11,5             | 1           | 36                 | 191,5                              | 240            |
| TOTAL<br>32 days ..    | 42                          | 110,5            | 2,5         | 60                 | 595                                | 768            |

TABLE 3  
THE FREQUENCY OF DIVISION IN RB TROOP AND THE NUMBER OF HOURS DIVIDED

| Period                   | Frequency<br>of<br>division | Hours divided    |             |                    | Hours<br>together<br>day and night | Total<br>hours |
|--------------------------|-----------------------------|------------------|-------------|--------------------|------------------------------------|----------------|
|                          |                             | Day<br>Core area | Day<br>Veld | Night<br>Core area |                                    |                |
| 10 days<br>Oct. '67 ..   | 5                           | 9,5              | —           | —                  | 230,5                              | 240            |
| 8 days<br>Feb./March '68 | 3                           | 1                | 1           | 8                  | 182                                | 192            |
| 5 days<br>August '68 ..  | 1                           | 2,5              | 1           | —                  | 116,5                              | 120            |
| TOTAL<br>23 days ..      | 9                           | 13               | 2           | 8                  | 529                                | 552            |

period on W, the total hours of separation during the day for both troops was almost identical and differed completely from the number of hours W troop was separated during the day in the July, 1967 and January, 1968 periods.

During the July, 1968 period W left their usual home range and core area, and used the sleeping places of other troops on the border of their home range for four nights. They usually left for the new areas in the morning, spent the night there and returned to their own area during the late afternoon of the following day.

*(d) The composition of sub-troops**(i) Normally composed sub-troops*

A normal sub-troop resembles the normal sex and age composition of a troop and consists of 50% adults and 50% young with a 1 : 2 ratio between adult males and females. W troop divided at any time of the day, but especially in the early morning when a group of about twenty animals visited the area behind the hotel where they received the left-over porridge from the hotel staff. Visual contact was, however, usually maintained between these animals and the rest of the troop. The troop divided into two groups on three occasions while in their feeding grounds. No visual or auditory communication existed between the two sub-troops. RB troop also divided into normal sub-troops but visual or auditory contact was always maintained during the period of separation.

Field example: 16.10.67 – 1100 h:

1100. Eighteen individuals of RB troop, including three infants, strayed from the main sub-troop to forage high along the mountain above the drinking place. No vocal communication was heard.

1500. The main sub-troop left for their sleeping place, PK, and although 1 km away, the small sub-troop followed almost immediately. It was obvious from the behaviour of the small sub-troop that visual contact must have been maintained.

*Comment*

When sleeping apart these normally composed sub-troops rejoined first thing in the morning. Males started barking at 0500 h to establish contact between the sub-troops. Visual contact was impossible due to topographical barriers. Eleven members (two males, two females and seven young animals) of RB troop once arrived at N sleeping place which was already occupied by troop KMO. The rest of RB troop was in PK's sleeping place. Only 35 baboons had been counted in RB troop the previous morning and it was concluded that this small party had been on its own for at least two days.

Troop O, in the population study area, was recorded to consist of 94 baboons on various occasions. Afterwards two troops consisting of about 70 and about 20 baboons respectively, were often observed. It was not clear whether these two troops were independent troops that fed together during several of the encounters or whether it was one troop in the stage of dividing into two troops.

*(ii) Abnormally composed sub-troops*

An abnormally composed sub-troop consisted of any particular number of animals without any relation to sex and age. Abnormal sub-troops were separated from the troop for a few minutes or a few hours during the day or night. Usually these abnormally composed sub-troops were familiar with the whereabouts of the rest of the troop.

Once four juveniles of W troop wandered 500 m from the rest of the troop to scan the area behind the hotel for left-over porridge. The observer surprised them and they fled back to the



troop which had remained where they had left it. During their absence there had been no visual or auditory contact between them and the troop.

Y and a female were once on the garbage dump by themselves while the rest of W troop was in the orange orchard on Hyoma, about 2 km from the dump. The two animals showed no signs of uneasiness. On five occasions Y, accompanied by mothers and infants, slept in the alternative sleeping place while the rest of W troop invaded the main site. Typically Y, with his group, would remain on the lower slopes of the southern side of the kopje long after the rest of the troop had left for the main sleeping site. As darkness fell he would lead the group which moved in single file to the alternative site. The following example demonstrates the formation of an abnormal sub-troop in troop W.

Field example: 22 7.68. 0718 h:

0718. B and ST left for the feeding grounds with two-thirds of W troop. The rest of the troop, including eleven mothers with infants (out of a total of 13 in the troop), stayed behind with Y.

0724. Some of the mothers with Y gave constant communication calls, but the two sub-troops were now separated by more than a kilometre and topographical obstacles prevented contact.

0731. Y followed the other sub-troop. Two subdominant males walked on either side and a little ahead of Y, while the mothers followed Y in single file.

0739. Y sat down. The rest of his sub-troop kept walking. When all the sub-troop members had passed Y, he jumped up and hastily resumed the lead.

0747. Visual contact was re-established between the two sub-troops. Y sat down while members of his sub-troop ran to meet the main sub-troop halfway. Excited calls and chatters were uttered while dominance demonstrations, e.g. mounting between juveniles, were performed.

The division in this case may be called "abnormal", since 84% of the mothers in the troop were in one sub-troop.

#### 4. *The survival of socially disturbed troops*

Data on the chances of survival of small troops were experimentally obtained. The numbers of seven troops were drastically reduced as part of a control project (Table 4). At least one adult or dominant male per troop was released after it had been marked with a bright polyethylene collar.

Troop 69 was followed for four days after its numbers had been reduced to six. The females

TABLE 4  
TROOPS SUBJECTED TO CONTROL OPERATIONS

| Troop No. | Original<br>troop size | Remaining<br>numbers | Sex and age classes of<br>the remaining members |   |      |      |   |
|-----------|------------------------|----------------------|---|---|------|------|---|
|           |                        |                      | ♂   | ♀ | Juv. | Inf. |   |
| 14        | 37                     | 7                    | 1   | 2 | 2    | 2    |   |
| 15        | 34                     | 5                    | 1   | ? | ?    | ?    |   |
| 20        | 22                     | 3                    | 1   | 2 | -    | -    |   |
| 21        | 25                     | 4                    | 1   | 1 | 1    | 1    |   |
| 22        | 29                     | 8                    | 2   | 1 | 4    | 1    |   |
| 23        | 32                     | 4                    | 1   | 2 | -    | 1    |   |
| 69        | 21                     | 7                    | 1   | 2 | 2    | 1    |   |
| Total     | 7                      | 200                  | 38  | 8 | 10   | 9    | 6 |

of this troop persisted in uttering communication calls throughout the day. The troop operated in a small area, mainly the "core area" of the original home range and they avoided other troops in the neighbourhood. After four months, they still occupied the same area and had still not joined any of the adjacent troops.

Troops 22 and 23 occupied the same area and sleeping hill. They were the only two troops that used this particular kopje. After their numbers had been reduced, these troops grew very secretive. They remained individual troops but were seen close together on one occasion.

In troop 21 only two adults, one male and one female were left, yet they remained a stable troop and were still utilizing their original home range four months later.

#### DISCUSSION

As in the case of rhesus monkeys, *Maccaca mulatta* (Altmann 1962; Southwick, Beg & Siddeque 1965; Koford 1963), and vervet monkeys, *Cercopithecus aethiops* (Struhsaker 1967), baboon troops W and RB also divided occasionally. It was not possible to determine whether the same females with infants followed the same males daily as was found for rhesus groups in North India and for hamadryas baboons in Ethiopia (Krummer & Kurt 1963; Kummer 1968).

It was usually impossible to recognize a group of baboons as a troop or a sub-troop without more detailed investigation. During the study period of 55 observation days RB and W divided 51 times. Division took place on 38 of the 55 days. If day and night are assumed to be of equal length, W troop was divided for 29% of the day and 18% of the night. RB troop, on the other hand, was divided for 5% of the day and 3% of the night which is possibly a more accurate reflection of the natural situation due to the artificial sources of food available to W.

Although the term sub-troops is preferred, it could also be called a band. Kummer *et al.* (1963) distinguished in hamadryas baboons between troops (= 100 + animals) and bands (= 30 to 90

animals). Bands were composed of one-male units and several bands formed a troop. As with the sub-troops now described bands may lag behind during the day and sleep apart. The term sub-troop should be used when detailed studies on ecology and behaviour are considered. No distinction is made between troops and sub-troops for the purpose of population census studies and general public use. The behaviour of sub-troops differs markedly from the behaviour of the natural undivided troop, thus the collection of quantitative data on behaviour can be affected.

As mentioned earlier, the behaviour of male Y at night was not clearly understood. However, later studies by myself and Jeanne Stoltz on the behaviour of semi-tamed juvenile baboons at the Loskopdam Nature Reserve, gave some indication of the possible cause of this behaviour. Two juvenile males of the juvenile troop were always last to enter their sleeping place at the end of their daily excursion. Social hierarchy determinations proved that these two males were subordinate to the other baboons in the troop. Male Y was afraid of the two other dominant males in W troop thus explaining his behaviour in picking up and carrying infants. In the process of avoiding aggressive attacks from the other males, Y and the mothers with infants slept together away from the rest of the troop. However, the social bond between members of W troop was strong enough to ensure Y's contact with the troop the next morning.

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